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THE BIOLOGY OF SMALL WHALES. (U)  
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Final Report:  
The Biology of Small Whales

William E. Evans

Work Unit No. NR 104-157  
Contract N00014-77-C-0212

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## Final Report: The Biology of Small Whales

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*Report pertains to*

This ~~was~~ a four year study of the biology and natural history of small whales (e.g. Globicephala and Grampus griseus) using aerial and ship surveys, radio telemetry, and remote sensing technology. Special emphasis was placed on determining relationships between the distribution and movement patterns of these species of small whales and various oceanographic parameters.

The following objectives were achieved during the course of this project:

1. Methods for attaching radio transmitters to small to medium sized whales without capture and restraining were investigated. Tests were conducted to determine the best materials for dart construction and methods of attachment, the possibilities of tissue rejection and infection, which would also result in rejection and possible deleterious effects on the test subject exist. Materials tested include type 304 stainless steel, surgical stainless steel, Delrin, Delrin (low temperature isotrophic carbon coated), Nylon, Nylon (low temperature isotrophic carbon coated). Several pin designs were tested, toggle head, cone, arrowhead (barbed), multiple cone head, four fluke head. The first three designs were tested in vivo using a Sus scrofa and a Delphinus delphis. Tests of the insertion and withdrawal force were made on all designs using carcasses of delphinids beach stranded or collected in association with NMFS study of dolphin mortality associated with the yellowfish tuna purse seine fishery. All materials with the exception

of stainless steel were rejected within 14 days or less. The stainless steel toggle head pins are still intact at the date of this report. The force necessary to withdraw the toggle head pin was too great to be recorded. The four head fluke (stainless steel) took over 100 psi to withdraw.

2. Aerial and ship surveys to determine the presence and distribution of Globicephala and Grampus in the Southern California Bight were conducted monthly during 1977 and 1978. Low and medium altitude aerial photography have provided data on herd size and composition. Additional data have been collected to verify the influence of bottom topography, surface temperature, and current on the distribution and movement patterns of both species. Grampus which normally seem to prefer warm temperate and tropical waters have been increasingly abundant in the Southern California Bight. This correlates well with the increase in mean monthly temperatures in the study area during 1977 and 1978. Increased water temperatures during 1981-82 have resulted in a similar increase in Grampus population levels.

During 1978-80, densities of Risso's Dolphins, Grampus griseus, and Killer whales, Orcinus orca, were estimated for the northeastern Pacific from Longitude 140W to the coast between Latitudes 15S and 50N from aerial and shipboard visual sightings. Both species were found to occur in highly productive continental shelf areas with strong horizontal currents and upwelling; however, both also extended into pelagic waters where factors affecting presence and abundance were not determined. Seasonal and long term changes in distribution and regional abundance of Grampus are related to surface water temperature. Densities of Orcinus were surprisingly unrelated to fishing activities of tuna purse seiners, which make marine mammal prey species readily available to them and were expected to cause concentration. Densities of Pilot Whales, Globicephala sp., were estimated for the Southern California Bight. There, Globicephala prefer deep

water regions at all seasons but concentrate in Winter/Spring at heads of deep submarine canyons with extreme changes in water depth in short horizontal distances. Such areas support incredibly large concentrations of spawning squid at this time of year.

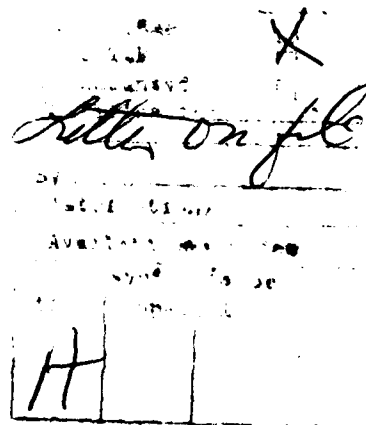
3. Broad-scale correlations of cetacean abundance with measures of productivity depend on accuracy of abundance of density measurements. Accuracy of abundance and density estimates depend in turn on visibility of the animals, and accuracy of estimates of their distance from the sighting platform. We have investigated a method of censusing cetaceans which is not affected by changes in visibility due to darkness, high winds, or obscured skies. An experimental ship-towed linear hydrophone array (towed-array) was used from a surveying vessel to listen for sounds produced by cetaceans and other organisms. Herds of dolphins were simultaneously detected visually and acoustically. Two herds of dolphins and one of pilot whales not seen by ship observers were detected acoustically to distances of 3-4nm. Pilot whales located in this manner were still detectable acoustically when the vessel was 5-6nm past them.

4. In October 1980 we jointly hosted (along with the Program in Cognitive Science, University of California, San Diego) a workshop of fifteen invited scientists entitled "Potentials for Research on Cognition in Dolphins and Human-Dolphin Communication". Areas of discussion included problems in characterizing the perceptual world of dolphins, comparative learning capacities of dolphins and chimpanzees, the significance of brain size in relation to intelligence, and training techniques and methodology. A transcript of this workshop is currently being prepared for publication. The participants also discussed the organization of a larger "state-of-the-art" conference to be held in the future. This conference is currently in the planning stages.

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